527 CMR 39.00: WELDING AND CUTTING PROCESSES

Section

39.01: Purpose

The purpose of 527 CMR 39.00 is to provide minimum standards to prevent loss of life and property from fire during cutting and welding processes involving the use of oxygen-fuel gas and electric arc cutting and welding equipment.

39.02: Scope

527 CMR 39.00 shall apply to the use of electric arc cutting and welding equipment and to the use of oxygen-fuel gas cutting and welding systems comprised of a single cylinder of oxygen, a single cylinder of fuel gas, regulators, hose and a torch.

39.03: Definitions

For the purpose of 527 CMR 39.00, the following terms shall have the meanings respectively assigned to them:

Acetylene, medium pressure: Acetylene at pressures exceeding two psig but not exceeding 15 psig.

Approved: Approved by the State Fire Marshal.

Compressed Gas: Any material or mixture having in the container an absolute pressure exceeding 40 psia (276 kPa absolute) at 70°F (21.1°C), or regardless of pressure at 70°F (21.1°C), having an absolute pressure exceeding 104 psia (717 kPa absolute) at 130°F (54.4°C).

Fire Resistant: Refers to materials which are noncombustible throughout and can withstand a fire completely consuming adjacent combustibles without collapse.

Fuel Gas: Acetylene, hydrogen, LP-Gas, and other liquefied and nonliquefied gases, any of the following hydrocarbons or mixtures of the same: propane, propylene, butanes (normal or isbutane), and butylenes.

Noncombustible Material: Any material which, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors,

when subjected to fire or heat. Materials reported as noncombustible when tested in accordance with the Standard Method of Test for Noncombustiblility of Elementary Materials, ASTM E136, shall be considered noncombustible materials.

Permit system: Administrative procedures that provide authorization for a management control of welding and cutting operations. The management control shall include supervisory responsibility for the safe conduct of the welding and cutting. A permit system and associated safety practices shall be in conformance with a nationally recognized consensus standard, model fire prevention code, insurance or industry practice or United States Department of Labor OSHA regulations such as the following:

(a) 29 CFR 1910.225 Subpart Q, Welding, Cutting and Brazing.

(b) American Petroleum Institute Publication 2009, *Safe Welding and Cutting Practices in Refineries, Gasoline Plants and Petrochemical Plants*, 5th ed., August, 1988.

(c) American Welding Society ANSI/AWS Z49.1-1988, *Safety in Welding and Cutting*.

(d) Building Officials and Code Administrators, *The BOCA National Fire Prevention Code*, 1993 edition; Chapter 22 Welding or Cutting, Calcium Carbide and Acetylene Generators.

(e) Factory Mutual Publication P9104, *Hot Work Policy, Precautions and Permission*.

(f) National Fire Protection Association, NFPA 51B-1994 ed., *Standard for Fire Prevention in Use of Cutting and Welding Processes*.

Person: Includes a corporation, firm, partnership, association, organization and any other group acting as a unit as well as individuals.

39.04: Permits Required:

(1) A permit shall be obtained from the head of the fire department by the person performing welding or cutting operations. The permit shall specify the time and exact location of the work to be performed, the nature of the work to be done, and any special precautions to be taken during that work.

EXCEPTION: A permit shall not be required for the following conditions:

(a) Whenever welding or cutting is performed in areas approved for the purpose by the head of the fire department.

(b) For each welding or cutting job location where a permit system has been approved by the head of the fire department after which a permit shall have been issued for the area where the management has control as required under the permit system.

(c) For welding and cutting by persons employed by companies or firms engaged in the storage, transportation, or distribution of natural gas under the jurisdiction of the Massachusetts Department of Public Utilities according to 220 CMR 100.00 through 112.00, and/or the United States Department of Transportation, Office of Pipeline Safety according to 49 CFR 191 through 193.

(2) Prior to the issuance of the permit the applicant shall provide written authorization signed by the property owner or his agent describing the scope and specific locations where the work is to be performed.

(3) A permit for the storage of fuel gases during welding or cutting operations shall be obtained from the head of the fire department under the provisions of 527 CMR 6.00 or 527 CMR 14.00. The head of the fire department may issue a single permit for both operation (527 CMR

39.04(1)) and storage (527 CMR 39.04(3)).

39.05: General Requirements

(1) In the performance of welding and cutting operations, only approved equipment shall be used and the equipment shall be installed and operated in accordance with 527 CMR 39.00, the manufacturer's instructions, and nationally recognized good practice.

(2) A permit for welding or cutting operations shall not be issued unless the individual in charge of performing such operations is deemed to be capable of doing such work in a safe manner by the head of the fire department. Demonstration of a knowledge of 527 CMR 39.00 and equipment operations shall constitute acceptable evidence of compliance with 527 CMR 39.05.

(3) A fire watch shall be provided to safeguard against the ignition of any material by the welding or cutting operation, to make use of portable fire extinguishers or fire hose, and to perform similar fire prevention and fire protection duties. The fire watch shall remain on the job at least 30 minutes after the welding or cutting operations have been completed to insure that no fire exists. A signed inspection report attesting to that fact shall be filed and available for inspection by the head of the fire department.

(4) A record shall be maintained of all locations where welding or cutting operations are performed. The record shall state the name of the assigned fire watch or watches and the length of time for which the fire watch standby was continued after work was completed (a minimum of 30 minutes). It shall include the date, time, and specific location at which work was done and describe the work, fire protection provided, and special precautions taken. Individual job authorizations shall be kept available at all times for inspection by the head of the fire department or his designee. The assigned fire watch or fire watches shall sign the work authorization attesting to the fact that no fire existed after the work ceased and the standby period had passed.

(5) Where welding or cutting is done near walls, partitions, ceiling, or roof of combustible construction, fire resistant shields or guards shall be provided to prevent ignition. When welding or cutting is to be done on a metal wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side due to conduction or radiation. A fire watch shall be required on the other side of the exposed wall, partition, ceiling or roof if there is any danger of the welding or cutting on one side to result in ignition of materials or structure on the unexposed side. Welding or cutting shall not be attempted on a metal partition wall or on partitions of combustible sandwich-type panel construction.

39.06 Fire Safety Requirements

(1) Cutting or welding operations shall be performed only in areas that have been protected against the ignition and spread of fire.

(2) Within the confines of an operating plant or structure cutting or welding shall be done in specific areas designed and approved for such work as a maintenance shop, an outside location or a detached structure which shall be of noncombustible or fire resistive construction.

(3) When work cannot be moved as in most construction or structural modification activity, the area shall be made fire safe by removing all combustible material within a distance of 35 feet and all combustible material from beneath the location where welding or cutting is to be performed.

(4) When work cannot be relocated and combustible material cannot be feasibly relocated, all combustible material exposed within 35 feet horizontally or beneath the cutting or welding operation or within 35 feet of exposed floor, ceiling or wall openings shall meet the following requirements:

(a) Such combustible construction or material shall be protected from possible sparks, hot metal or oxide by fire resistive shields or noncombustible covers as required by the head of the fire department.

(b) Such floor, ceiling or wall openings shall be protected by fire resistive shields and openings or cracks in walls, floors or ducts shall be tightly covered to prevent the passage of sparks or slag to adjacent areas.

(5) At least one portable fire extinguisher having a rating of not less than 4-A:60-B:C shall be kept at the location where welding or cutting is done and at least one portable fire extinguisher having a rating of not less than 2-A:10-B:C shall be attached to all portable welding carts.

(6) Welding or cutting shall not be done in or near rooms or locations where flammable gases, liquids or vapors, lint, dust or loose combustible stocks are present when sparks or hot metal from the welding or cutting operations may cause ignition or explosion of such materials.

(7) Welding or cutting shall not be performed in the presence of explosive atmospheres or on containers, equipment, or in hollow spaces or cavities which contain or have contained flammable fluids, gases or solids until these containers or equipment have been thoroughly cleaned, inverted or purged. Upon request a certificate of completion or a receipt for services from a firm, company or corporation authorized in the removal and disposal of hazardous materials shall be presented to the head of the fire department at the time of application for permit.

(8) Sprinkler protection shall not be shut off while welding and cutting work is being performed. When welding or cutting is done close to automatic sprinkler heads, noncombustible board products or damp cloth guards shall be used to shield the individual heads, but shall be removed when the work is completed.

(9) Where a sprinkler system will be impaired or rendered inoperative for any reason, this shall be noted in the application for permit so that all necessary precautions may be taken as required by the head of the fire department.

(10) Hot tapping or other welding or cutting on a flammable gas or liquid transmission or distribution utility pipeline shall be performed only by persons specifically designated and qualified to perform such work.

39.07: Oxyfuel Gas Welding and Cutting

(1) Terminology.

(a) Oxygen shall be referred to by its proper name Oxygen and not by the word Air.

(b) Fuel gases shall be referred to by their proper names, such as acetylene, propane, natural gas, and not by the word Gas.

(2) Oxygen and Combustibles.

(a) Oxygen cylinders, cylinder valves, couplings, regulators, hoses, and apparatus shall be kept free from oily or greasy substances. Oxygen cylinders or apparatus shall not be handled with oily hands or gloves.

(b) Oxygen shall not be used as a substitute for compressed air. Oxygen shall not be used in pneumatic tools, in oil preheating burners, to start internal combustion engines, to blow out pipelines, to dust clothing or work, or to create pressure for ventilation or similar applications. Jets of oxygen shall not be permitted to strike an oily surface, greasy clothing, or enter fuel oil or other storage tanks.

(c) Oxygen cylinders, equipment, pipelines, or apparatus shall not be used interchangeably with any other gas.

(3) Attachments for Gas Mixing. No device or attachment facilitating or permitting mixtures of air or oxygen with flammable gases prior to consumption, except at a burner or in a torch, shall be allowed unless approved for the purpose.

(4) Torches.

(a) Only approved torches shall be used.

(b) Connections shall be tested for gas tightness after assembly and before lighting the torch. Use soapy water or the equivalent, not a flame.

(c) Before lighting the torch for the first time each day, hoses shall be purged individually. This consists of allowing each gas to flow through its respective hose separately, long enough to purge out any flammable gas mixture in the hose. Hoses shall not be purged into confined spaces or near ignition sources.

(d) Used as a friction lighter, stationary pilot flame, or other suitable source of ignition. Do not use matches or cigarette lighters for lighting torches; do not attempt to light or relight torch from hot metal in a small cavity, hole, furnace, etc., where gas might accumulate. Point the torch away from persons or combustible materials.

(e) Manufacturers procedures shall be followed with respect to the sequence of operations in lighting, adjusting, and extinguishing torch flames.

(f) To minimize the possibility of gas accumulation in confined space due to leaks or improperly closed valves when gas welding or cutting is completed, the torch valves shall be closed and in addition, the fuel gas and oxygen supply to the torch shall be positively shut off at a point outside the confined area whenever the torch is not being used for a substantial period of time, such as during lunch or overnight. Where practicable, the torch and hose shall be removed from the confined space.

(5) Hose and Hose Connections.

(a) Hose for oxyfuel gas service shall comply with Specification IP-7 for Rubber Welding Hose, Compressed Gas Association and Rubber Manufacturers Association.

(b) Metal-clad or armored hose is not recommended. However, as part of a machine or an appliance when conditions of use make metal reinforcing advantageous, hose may be used in which such metal reinforcing is exposed to neither the inside gases nor the outdoor atmosphere.

(c) Hose shall be identified by exterior colors using red for fuel gas hose, green for oxygen

hose, and black for inert-gas and air hose.

(d) When parallel lengths of oxygen and fuel gas hose are taped together for convenience and to prevent tangling, not more than four inches in each 12 inches shall be covered by tape.

(e) Hose showing leaks, burns, worn places, or other defects rendering it unfit for service shall be repaired or replaced.

(f) Hose connections shall comply with the standard hose connection specification, Compressed Gas Association pamphlet E-1

(g) Hose connections for welding gas lines shall not be compatible with connections for breathing air.

(i) When an approved device such as a hose check valve or flash-back arrestor is used in an oxyfuel gas welding and cutting torch system, the device shall be used and maintained in accordance with the manufacturer instructions.

(6) Pressure-Reducing Regulators.

(a) Only approved pressure reducing regulators shall be used.

(b) Pressure reducing regulators shall be used only for the gas and pressures for which they are labeled. The regulator inlet connections shall comply with Compressed Gas Cylinder-Valve Outlet and Inlet Connections, Compressed Gas Association Standard V-1. Regulators shall not be interchanged among designated gas services.

(c) Union nuts and connections on regulators shall be inspected before use to detect faulty seats which may cause leakage when the regulators are attached to cylinder valves or hoses. Damaged nuts or connections shall be replaced.

(d) Gauges used for oxygen service shall be marked "USE NO OIL".

(e) Oxygen regulators shall be drained of oxygen before they are attached a cylinder or before the cylinder valve is opened (see also 527 CMR 39.07(10)(d) and (10)(k)). The regulator attached to a cylinder can be drained of oxygen by momentarily opening and then closing the downstream line to the atmosphere with the regulator adjusting screw engaged and the cylinder valve closed. The cylinder valve is then opened slowly. The oxygen cylinder connection shall be wiped clean with a clean cloth, free of oil and lint, and the cylinder valve "cracked" before connecting the regulator. Oxygen cylinder valves shall always be opened slowly.

(f) When regulators or parts of regulators, including gauges, need repair, the work shall be performed by persons who have been properly instructed.

(7) Cylinders (Containers).

(a) All portable cylinders used for storage and shipment of compressed gases shall be constructed and maintained in accordance with regulations of the U.S. Department of Transportation (DOT). Such compliance will be recognized by markings on the cylinder, usually on the top shoulder, with the applicable DOT specification number (ICC number on older cylinders) and by retest dates where applicable.

(b) No one except the owner of the cylinder or person authorized by the owner shall fill a cylinder.

(c) No person other than the gas supplier shall mix gases in a cylinder or transfer gases from one cylinder to another.

(d) Compressed gas cylinders shall be legibly marked with either the chemical or trade name of the gas in conformance with the Method for Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Standard Z48.1, for the purpose of identifying the gas content. Such markings shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Do not use cylinders on which the labeling is missing or illegible. Return such cylinders to the supplier.

(e) The numbers and markings stamped into cylinders shall not changed except in conformance with DOT regulations.

(f) Compressed gas cylinders shall be equipped with connections complying with the Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, ANSI/CGA V-1.

(g) All cylinders with a water weight capacity over 30 lb shall be equipped with a means of connecting a valve protection cap or with a collar or recess to protect the valve.

(h) The temperature of the cylinder contents shall not be allowed to exceed 130° F.

(8) Cylinder Storage.

(a) Cylinders shall be stored where they will not be exposed to physical damage, tampering by unauthorized persons, or subject to temperatures which would raise the contents above 130° F.

(b) Cylinders shall be stored away from elevators, stairs, or gangways in assigned places where cylinders will not be knocked over or damaged by passing or falling objects. Cylinders shall be secured in storage to prevent falling.

(c) Cylinders in storage shall be separated from flammable and combustible liquids, and from easily ignited materials such as wood, paper, packaging materials, oil, and grease by at least 20 ft, or by a noncombustible barrier at least five feet high having a fire resistance of at lease ½ hour.

(d) Oxygen cylinders in storage shall be separated from fuel gas cylinders by a similar distance or barrier as described in 527 CMR 39.07(8)(c).

(e) Acetylene and liquefied gas cylinders shall be stored and used valve end up.

(f) Fuel gas storage limits shall be in accordance with the provisions of 527 CMR 6.00 and 527 CMR 14.00, as required.

(9) Cylinder Handling.

(a) Cylinders shall not be dropped, struck, or permitted to strike objects violently in a manner which may damage the cylinder, valve, or safety device.

(b) Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed. The use of warm (not boiling) water is recommended.

(c) Cylinders shall not be used as rollers or supports, whether full or empty.

(d) Safety devices shall not be tampered with.

(e) Cylinder valves shall be closed before moving cylinders.

(f) Valve protection caps, where the cylinder is designed to accept a cap, shall always be in place and hand tight except when cylinders are in use or connected for use.

(g) Valve protection caps shall not be used for lifting cylinders.

(h) When transporting cylinders by a crane or derrick, a cradle or suitable platform shall be used. Slings or electromagnets shall not be used for this purpose.

(i) When cylinders are transported by motor vehicle, they shall be secured in position.

(j) When cylinders are to be moved with regulators attached, the cylinder shall be secured in position when moved, and cylinder valve closed.

(10) Cylinder Use.

(a) Compressed gas shall not be used from cylinders without reducing the pressure through a suitable regulator attached to the cylinder valve unless the equipment used is designed to withstand full cylinder pressure.

(b) Acetylene shall not be used at a pressure in excess of 15 psig or 30 psia. The 30 psia limit is intended to prevent unsafe use of acetylene in pressurized chambers such as caissons,

underground excavations, or tunnel construction. 527 CMR 39.07(10)(b) shall not apply to storage of acetylene dissolved in a suitable solvent in cylinders manufactured and maintained according to DOT requirements.

(c) Before connecting a regulator to a cylinder valve, the valve outlet shall be wiped clean with a clean cloth free of oil and lint, and the valve shall be opened momentarily and closed immediately. This action, generally termed "cracking" is intended to clear the valve of dust or dirt that otherwise might enter the regulator. The valve shall be "cracked" while standing to one side of the outlet, not in front of it. A fuel gas cylinder valve shall not be "cracked" near other welding or cutting work or near sparks, flame, or other possible sources of ignition.

(d) The following shall be done after the regulator is attached to oxygen cylinders:

1. Engage the adjusting screw and open the downstream line to drain the regulator of gas.

2. Disengage the adjusting screw and open the cylinder valve slightly so that the regulator cylinder-pressure gauge pointed moves up slowly before opening the valve all the way. Stand to one side of the regulator and not in front of the gauge faces when opening the cylinder valve. If oxygen high pressure is suddenly applied, it is possible to cause ignition in the regulator and injure the operator.

(e) A hammer or wrench shall not be used to open the cylinder valves that are fitted with hand wheels.

(f) Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while these cylinders are in service so that the gas flow can be turned off quickly in case of emergency.

(g) When a high-pressure (nonliquefied) gas cylinder is un use, the valve shall be opened fully in order to prevent leakage around the valve stem.

(h) An acetylene cylinder valve shall not be opened more than approximately 1½ turns and preferably no more than ¾ of a turn. This is so that it may be closed quickly in case of emergency.

(i) Nothing shall be placed on top of a cylinder when in use which may damage the safety device or interfere with the quick closing of the valve.

(j) Cylinder valves shall be closed when work is finished.

(k) Before a regulator is removed from a cylinder, the cylinder valve shall be closed and the gas released from the regulator.

(l) A suitable cylinder truck, chain, or steadying device shall be used to keep cylinders from being knocked over while in use.

(m) Cylinders shall be kept far enough away from actual welding or cutting operations so that sparks, hot slag, or flame will not reach them, otherwise fire resistive shields shall be provided.

(n) Cylinders shall not be placed where they might become part of an electrical circuit. Contacts with third rails, trolley wires, etc., shall be avoided. Cylinders shall be kept away from radiators, piping systems, layout tables, etc., that may be used for grounding electric circuits such as for arc welding machines. The tapping of electrodes against a cylinder shall be prohibited. Do not strike an arc on cylinders.

(11) Cylinder Emergencies.

(a) If a leak is found around the valve stem of a fuel gas cylinder, the packing nut shall be tightened, or the cylinder valve closed.

(b) If tightening the packing nut does not stop a valve stem leak, or if a fuel gas valve is leaking at the seal and cannot be stopped by closing the valve firmly, or if a leak should develop at a cylinder fuse plug or other safety device, then the fuel gas cylinder shall be

moved to a safe location outdoors away from any source of ignition, marked properly, and the supplier advised. A warning sign shall be posted not to approach the cylinder with a lighted cigarette or source of ignition. The cylinder valve may be opened slightly to gradually discharge the contents.

(c) Small fires at fuel gas cylinders, usually resulting from ignition of leaks, shall be extinguished, if possible, by closing the cylinder valve or by the use of water, wet cloths, or fire extinguisher. The leaks shall then be treated as described in 527 CMR 39.07(11)(a) and (11)(b).

(d) In the case of a large fire at a fuel gas cylinder, such as from the functioning of a fuse plug or safety device, persons shall be evacuated from the area, and the cylinder kept wet down with a heavy water stream to keep it cool. It is usually better to allow the fire to continue to burn and consume the escaping gas, otherwise it may reignite with explosive violence. If circumstances permit, it is often better to allow the cylinder fire to burn out in place rather than attempt to move the cylinder. If the cylinder is located where the fire should not be allowed to burn out in place, attempts may be made to made to move it to a safer location, preferably outdoors. Personnel shall remain as distant as possible, and the cylinder shall be kept cool with a water stream.

39.08: Electric Arc Welding and Cutting

(1) The frame or case of electric arc welding or cutting machines, except internal combustion engine driven machines, shall be grounded in accordance with the requirements of 527 CMR 12.00, the Massachusetts Electrical Code.

(2) Welding current return circuits from the work to the machine shall have proper electrical contact at all joints and periodic inspection shall be made to ascertain that proper electrical contact is maintained.

(3) Written rules and instruction covering the safe operation of equipment shall be made available to the welder and shall be strictly followed.

(4) When electric arc welding or cutting is to be discontinued for one hour or more, such as during lunch hour or overnight, all electrodes shall be removed from the holders, the holders shall be carefully located so that accidental contact cannot occur, and the machine shall be disconnected from the power source.

(5) Maintenance

(a) All arc welding equipment shall be maintained in safe working order at all times. The welder or maintenance personnel shall report any equipment defect or safety hazard to be supervisor, and the use of such equipment shall be discontinued until its safety has been assured. Repairs shall be made by qualified personnel only.

(b) Welding equipment shall be maintained in good mechanical and electrical condition to avoid unnecessary hazards. Commutators shall be kept clean to prevent excessive flashing.

(c) Rectifier welders shall be inspected frequently to detect accumulations of dust or lint that would interfere with ventilation. Electrical coil ventilation ducts shall be similarly inspected and cleaned. It is good practice to blow out the entire welding machine with clean, dry compressed air using adequate safety precautions.

(d) Fuel systems on engine-driven machines shall be inspected and checked for possible leaks and accumulations of water that might cause rusting. Rotating and moving components shall be kept properly shielded and lubricated.

(e) Welding equipment used in the open shall be protected from inclement weather

conditions. Protective covers shall not obstruct the ventilation necessary to prevent overheating of the machine.

(f) Air filters in the ventilating system of the electrical components are not recommended, unless provided by the manufacturer of the welding machine. The reduction of air flow resulting from the use of an air filter on equipment not so designed can subject internal components to an overheating condition and subsequent failure.

(g) Machines which have become wet shall be thoroughly dried and properly tested before being used. When not in use, the equipment shall be stored in a clean, dry place.

(h) Welding cable shall be inspected for wear or damage. Cables with damaged insulation or connectors shall be replaced or repaired to achieve the mechanical strength, insulating quality, electrical conductivity, and watertightness of the original cable. Joining lengths of cables shall be done by means specifically intended for the purpose. The connection means shall have insulation adequate for service conditions.

(i) Use of compressed gases for shielding arc welding operation shall be in accordance with the applicable provisions of 527 CMR 39.06 and 39.07.

(6) Resistance Welding.

(a) All resistance welding equipment shall be selected for safe application to the work intended. The personnel safety aspects of resistance welding shall be given consideration when choosing equipment for the work to be performed.

(b) Workers designated to operate resistance welding equipment shall have been properly instructed and judged competent to operate such equipment.

(c) All resistance welding equipment and operations shall be in conformance with the provisions of 527 CMR 12.00 the Massachusetts Electrical Code. The equipment shall be installed by qualified personnel in accordance with the manufacturer's instructions.

39.09: Referenced Publications

Documents or portions thereof that are referenced within 527 CMR 39.00 shall be considered a part of the requirements of 527 CMR 39.00. Refer to 527 CMR 49.00 for a complete listing of all documents referenced in 527 CMR.

REGULATORY AUTHORITY

527 CMR 39.00: M.G.L. c. 22, §14; c. 148, §10.